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IS 2980 (1999): Non-Pressure Stoves [MED 26: Oil Burning Appliances]

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बिना-दाब स्टोव – विशिष्टि

(तीसरा पुनरीक्षण)

Indian Standard

NON-PRESSURE STOVES — SPECIFICATION

(*Third Revision*)

ICS 97.040.20

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

December 1999 Price Group 6

AMENDMENT NO. 1 OCTOBER 2003
TO
IS 2980: *1999* NON-PRESSURE STOVES — SPECIFICATION

(Third Revision)

(Page 5, *clause* 6.2) — Insert the following at the end:

'Thermal efficiency may be declared, if it is more than 60 percent and above.'

(Page 7, *clause* 8.1(f)] — Insert the following at the end:

'g) Thermal efficiency of 60 percent and above, when declared in accordance with 6.2 may use green label.'

(Page 7, *clause* 9.1) — Insert the following new clause after 9.1:

'9.1.1 Thermal efficiency above than the specified when declared in accordance with 6.2 may use green label.'

(ME 26)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 2 OCTOBER 2005
TO
IS 2980 : 1999 NON-PRESSURE STOVES — SPECIFICATION

(Third Revision)

[Page 5, clause 6.2 (see also Amendment No. **1)] — Substitute the following for the existing:**

'Thermal efficiency may be declared, if it is 62 percent and above.'

[Page **7,** *clause* **8.1** *{see also Amendment No.* **1)] — Substitute the following for the existing:**

'g) Thermal efficiency when declared in accordance with 6.2 may use green label.'

[Page **7,** *clause* **9.1** *(see also Amendment No.* **1) J — Substitute the following for the existing::**

'9.1.1 Thermal efficiency when declared in accordance with 6.2 may use green label.'

(ME 26)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 3 JULY 2010
TO
IS 2980 : 1999 NON-PRESSURE STOVES — SPECIFICATION

(Third Revision)

[*Page* 7, *clause* **8.1**(g) (*see also Amendments No.* 1 *and* 2)] — Delete.

[*Page* 7, *clause* **9.1.1** (*see also Amendments No.* 1 *and* 2)] — Delete.

(ME 26)

Reprography Unit, BIS, New Delhi, India

Oil Burning Appliances Scctional Committee, HMD 26

FOREWORD

This Indian Standard (Third Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Oil Burning Appliances Sectional Committee had been approved by the Heavy Mechanical Engineering Division Council.

This standard was first published in 1964 and revised in 1979. Second revision was done in 1986. Third revision has been undertaken to incorporate 5 Amendments and other technical changes for its effective implementation. The following important modifications have been done in this revision:

a) In place of specifying conformity of kerosene oil used for testing to relevant Indian Standard IS 1459 it shall be ensured that oil is free from water.

b) The electroplating thickness of Ni on steel has been reduced from 10 µm to 5 µm as it was experienced that 5 µm thick plating would be adequate for the purpose.

c) The requirement of paints for internal and external surfaces of tank has been left upon the manufacturers to select so as to meet the resistance to abrasion test.

In the preparation of this standard assistance has been derived from BS 3300 : 1985 'Specifiation for paraffin unflued space heaters, cooking and boiling appliances for domestic use', issued by the British Standards Institution.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values *(revised)*'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

NON-PRESSURE STOVES — SPECIFICATION
(Third Revision)

1 SCOPE

This standard covers the requirements for the following types of non-pressure stoves:

a) Capillary-fed circular-wick type; and
b) Capillary-fed, multi-wick type.

2 REFERENCES

The Indian Standards listed in Annex A contain provisions which through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex A.

3 TERMINOLOGY

3.1 For the purpose of this standard, the terminology and nomenclature as indicated in Fig. 1 and 2 and defined below shall apply.

3.1.1 *Kindler*

A thick asbestos fabric covered with removable wire-gauge or inter-woven with metallic fibre used for lighting wicks. A typical kindler is shown in Fig. 3. The dimensions given are illustrative only.

3.1.2 *Flame Extinguisher*

A mechanism preferably a metallic ring suitable to cover the wick top without damaging the wicks to extinguish the flame of the burner. A typical flame extinguisher is shown in Fig. 4.

3.1.3 *Capillary-Fed Circular-Wick Stove*

A non-pressure stoves which a single-circular hollow wick is used to lift the fuel from container to the burner.

3.1.4 *Capillary-Fed Multi-Wick Stove*

A non-pressure stove in which a number of wicks are

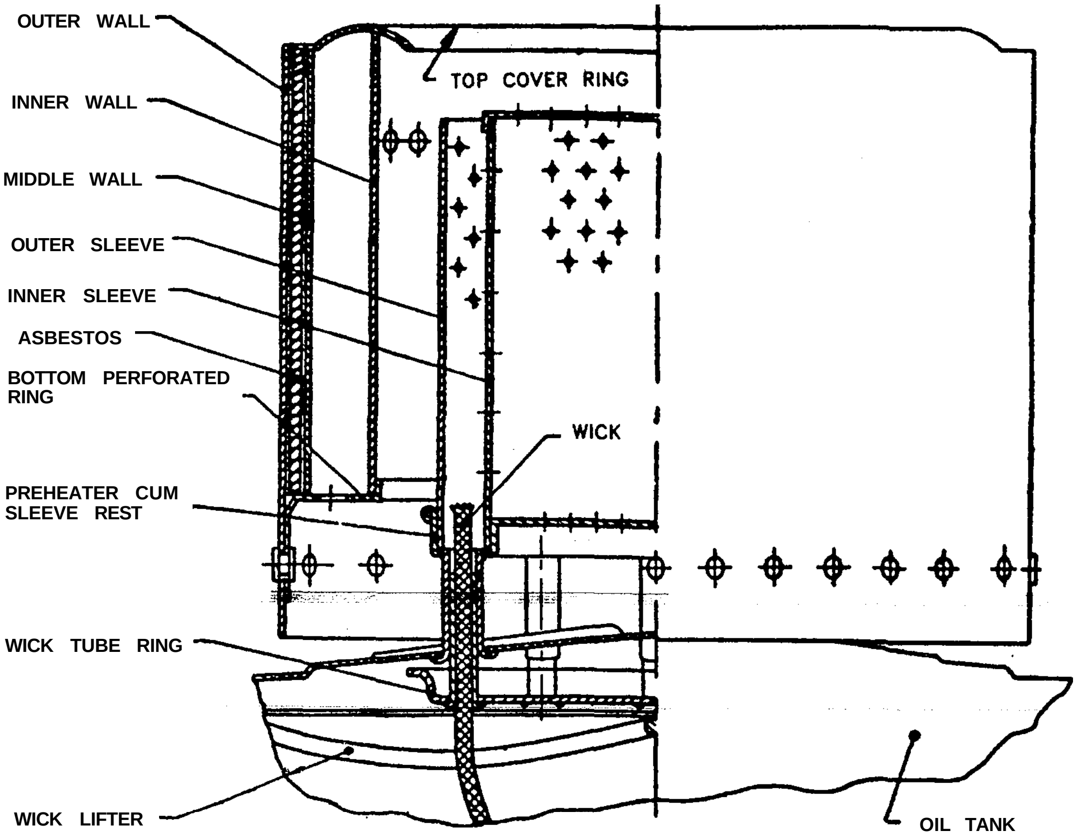


FIG. 1 NON-PRESSURE STOVE, CAPILLARY-FED, MULTI-WICK TYPE, TYPICAL

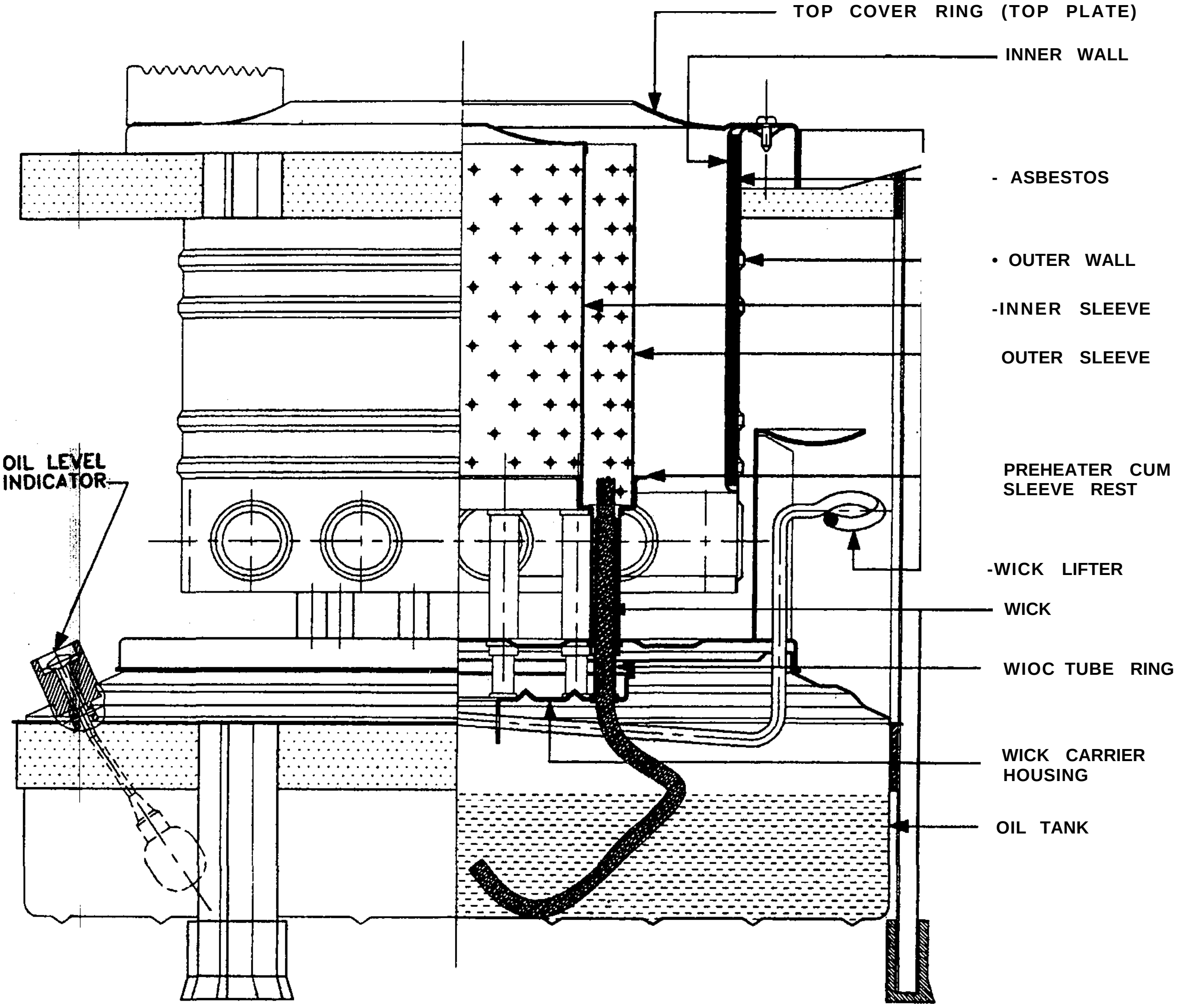
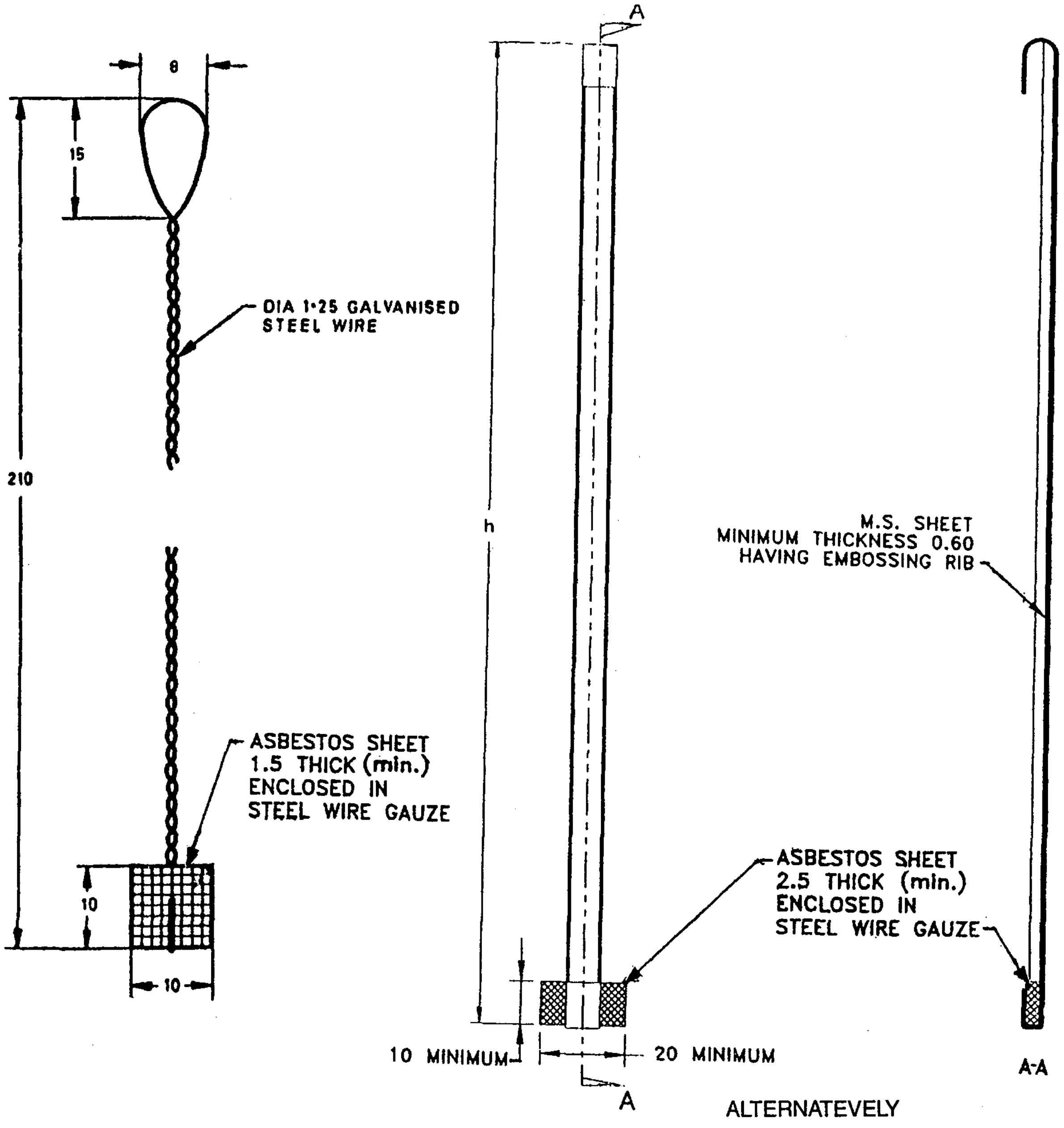


FIG. 2 TYPICAL DRAWING OF CAPILLARY-FED, MULTI-WICK TYPE NON-PRESSURE KEROSENE STOVE


8
15
210
DIA 1·25 GALVANISED STEEL WIRE
ASBESTOS SHEET 1.5 THICK (min.) ENCLOSED IN STEEL WIRE GAUZE
10
10
A
h
M.S. SHEET MINIMUM THICKNESS 0.60 HAVING EMBOSSING RIB
ASBESTOS SHEET 2.5 THICK (min.) ENCLOSED IN STEEL WIRE GAUZE
10 MINIMUM
20 MINIMUM
A
A-A
ALTERNATEVELY

NOTE — Length (A) of the Kindler shall be such that it should be minimum 70 mm, longer when measured from the outer edge of the top cover ring (top-plate), while the bottom edge of the Kindler should touch the preheater-cum-sleeve rest.

All dimensions in millimetres.

FIG. 3 KINDLER

used to lift the fuel from fuel container to the burner.

3.1.5 *Wick Carrier Housing*

Wick houses the wick raising mechanism.

3.1.6 *Thermal Efficiency*

Thermal efficiency of a stove may be defined as the ratio of heat available for actual utilization to the heat theoretically produced by complete combustion of a given quantity of fuel (which is based on net calorific value of the fuel).

4 MATERIAL

4.1 The sheet used in the manufacturing of fuel container and perforated sleeve shall be as specified in IS 513. The thickness of steel sheet used shall be such that the finished thickness of the fuel container at the bottom portion, excluding corners shall be not less than 0.40 mm and that of the perforated sleeves shall be not less than 0.35 mm.

4.1.1 Alternatively fuel container may also be made from either brass sheet conforming to IS 410 or

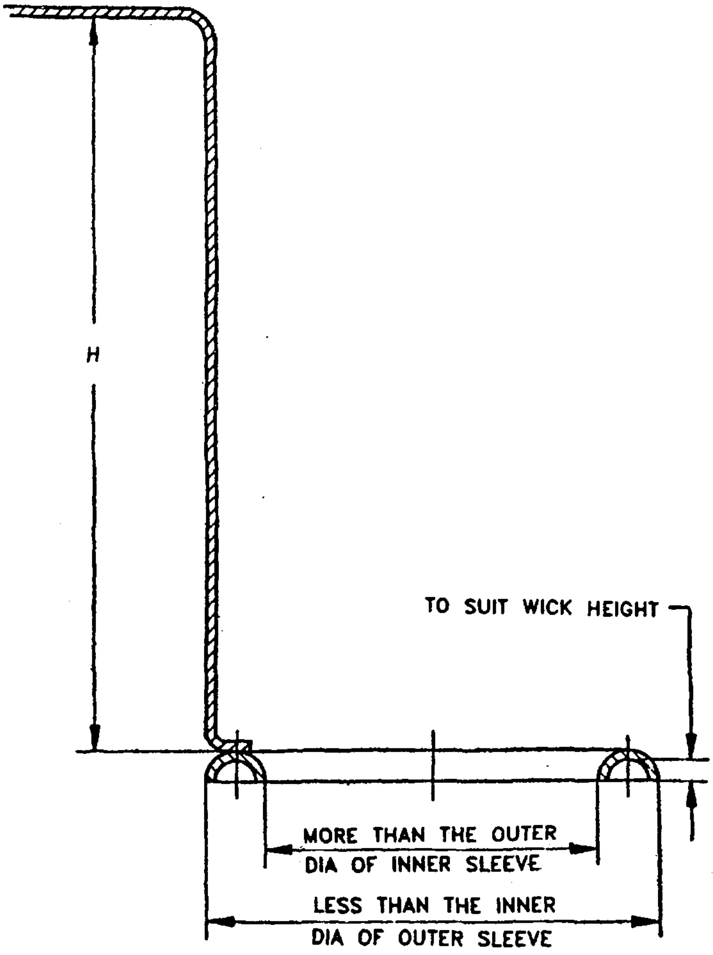

H
TO SUIT WICK HEIGHT
MORE THAN THE OUTER DIA OF INNER SLEEVE
LESS THAN THE INNER DIA OF OUTER SLEEVE

FIG. 4 FLAME EXTINGUIHSER

stainless steel sheet conforming to IS 6911 or from aluminium sheet conforming to IS 737 such that the final thickness of the fuel container at any place is not less than 0.40 mm in case of brass sheet, not less than 0.30 mm in case, the stainless steel sheet and not less than 0.60 mm in case of aluminium sheet. In case of perforated sleeve is also made from stainless steel sheet the final thickness shall not be less than 0.30 mm.

4.2 The material used for other parts of the stove shall be such that no distortion or breakage takes place while the stove is in normal use.

5 GENERAL REQUIREMENTS

5.1 The construction of the stoves shall be sturdy so that while in actual use on level floor, they cannot get shaky or yield at any point. Design of the stoves shall be such that the fuel container bottom does not touch the ground. The stoves shall be of either single burner or multiple burner construction. When two or more burners are provided on the stoves, the centre-to-centre distance shall be not less than 350 mm. The flame with the vessel placed over the stove shall be uniformly blue and shall spread evenly and radially outwards from the burner. The burners, the fuel container and any internal coating material shall be able to withstand the normal heat generated, when the stove is in operation.

5.1.1 The stove shall be so designed that the spillage shall not be excessive to cause fire hazards, when it is tilted.

5.1.2 The construction of the stove shall be such that the temperature of the fuel when measured in accordance with **6.7** shall not rise beyond 60°C during operation.

5.2 The fuel shall not leak at any point of the fuel lank and wick winder mechanism. Ait joints in the body of the tank shall be either welded or suitably locked. If the design of the fuel container involves a joint below the specified top level of the fuel, these joints shall be thoroughly sweated with solder or rubber lining compound all round to give an air tight and fuel tight joint. Such fuel containers shall be tested at a pneumatic pressure of 20 kN/m^2 (0.2 kgf/cm^2) for a period of 30 s to ensure fuel tightness.

5.3 The fuel container shall be of such capacity that it shall be possible to operate the stove at full output for a minimum period of 6 h without interruption when all the burners are in operation. Maximum fuel level shall be indicated on the fuel container and suitable means to identify the level shall be provided. The oil inlet of the fuel container shall be of sufficient diameter and the oil filler cap shall be capable of being easily screwed and unscrewed.

5.4 The knob for winding the wicks shall be readily accessible and easily adjustable when the appliance is alight. The design of burner assembly shall be such that the trimming of the wicks as well as lighting of the wicks can be done conveniently. The design of the stove shall be such that the ratio of overall height of stove to its base diameter shall be not more than 1.5:1.

5.5 Various components of stoves of one make shall be so made as to provide interchangeability. Removable components shall preferably be so constructed that they cannot be assembled incorrectly and where this is not possible, they shall be marked to show clearly their correct position. Supporting arrangement of the vessel on the stove shall be such that it shall not get detached or slip on its own, to prevent accidential tipping over.

5.6 The perforated sleeves shall sit properly and stay in position while in normal use.

5.7 Resistance to Corrosion

The fuel container of stove shall be made corrosion resistant by any of the following types of coating or combination thereof (that is, the two surfaces, external and internal, of fuel container may have different coatings). The inside surface of the fuel container may also be made corrosion resistant by phosphating only as per IS 3618.

5.7.1 The parts of the stove other than fuel tank shall have suitable coating to have a longer shelf life.

5.7.2 The painted surface of the stove shall conform to the test requirements given in **5.7.2.1.**

5.7.2.1 *Resistance to abrasion*

The apparatus required for this test shall be as given in Fig. 9 of IS 5116 with a one-mm diameter steel ball fixed at the end of a counterpoised arm which is kept horizontal.

Apply the apparatus to the surface under test and move the ball, after loading with not less than 1 000 g, at 3-4 cm/s relative to the surface. If the indicator bulb lights, the surface is deemed to have been penetrated. For metallic paints a visual examination of the scratch is necessary in order to determine whether the film has been penetrated. The finish is deemed to have failed if the scratch has jagged edges, is greater than one mm wide, or penetrates the film. Clean the ball after each test and inspect frequently to verify that it is a one-mm sphere.

NOTE — In case it is not possible to carry out the test on the stove, the test may be performed on the panels of size 100 mm × 50 mm prepared from the same material as of the fuel tank and processed under the same conditions as the stove.

5.8 For Single-Wick and Multi-Wick Stoves

Typical diagrams of each of a single-wick and multi-wick stoves are shown in Fig. **1** and **2.** The wicks shall be capable, of being raised or lowered smoothly without undue tightness, shake or play. Inner and outer wick tubes shall be sufficiently strong to avoid harmful distortion under normal use and shall be so mounted that fuel leakage in service is prevented. The wick carrier and winder mechanism shall give an even adjustment of the wicks and shall be so mounted that fuel leakage in service is prevented. In case of multi-wick type stove, all the wicks shall be capable of being raised or lowered simultaneously. **A** suitable wick-puller shall be provided with a multi-wick stove for inserting the wicks.

6 PERFORMANCE TESTS

6.1 Test conditions for carrying out all performance tests shall be in accordance with Annex B.

6.2 Thermal Efficiency Test

Thermal efficiency for each burner when tested in accordance with the method described in Annex C shall be not less than 60 percent for all types of non-pressure stoves.

6.3 Combustion Efficiency

When tested in accordance with the details laid down in Annex D, the carbon monoxide/carbon dioxide ratio of exhaust gases of each burner, while burning with maximum blue flame, shall not exceed 0.02.

6.4 Flame Stability Test

To perform this test, the fuel container shall be filled to three-fourths of the full capacity and the burner shall be lit. The flame shall be adjusted as soon as possible to the full flame size and may be readjusted if necessary during the first 15 min after lighting up. After that no adjustment shall be made to the flame during the test.

6.4.1 In the above described position the flame shall be observed for one hour when the vessel containing water is put on the stove. During this period, the flame shall not flicker or shall not cause an increase in flame size or the emission of visible smoke.

Base Material	*Type of Coating*	*Thickness*	*Test to be Qualified*
Steel	a) Painting *(see also* Note 1)	—	Resistance to abrasion as per 5.7.2.1
	b) Electropi.ited zinc coating *(see* IS 1573)	5 µm, *Min*	1) Thickness as per 9.2.1 of IS 1573 2) Adhesion test as per 9.3 of IS 1573
	c) Electroplating *(see also* Note 2)		
	i) Nickel plus chromium (Ni + Cr)	Ni = 5 µm, *Min* Cr = 0.2 µm, *Min*	1) Coating thickness as per 7.1 of IS 1068 2) Adhesion test as per 7.2 of IS 1068
	ii) Copper plus Nickel plus chromium (Cu + Ni + Cr)	Cu = 10µm, *Min* Ni = 5µm, *Min* Cr = 0.2 µm, *Min*	Same as at (1) above
Aluminium	Anodic coating (optional) *(see* IS 1868)	AC 10, *Min*	Thickness as per 5 of IS 1868

NOTES

1 The paints used for internal and external coating shall be such that the painted surface meets the resistance to abrasion test specified in 5.7.2.1. The recommended paint for internal coatings are petrol resistant as per IS 144, IS 145, IS 146 and IS 147 and for external coating enamel paints as per IS 2932 and IS 2933.

2 The surfaces such as spot welding spots, rivet tops, comers at holes, recesses and angular bases where control-led deposit ordinarily cannot be obtained, shall be excluded from the scope of significant surfaces.

6.5 Fuel Creep

There shall be no spreading of fuel over any external part of the appliance during u period of four hours following its fuel adjustment, when operated at the manufacturer's stated maximum blue flame setting and fuel container filled to three-fourths of its capacity.

6.6 Surface Temperature Test

The surface temperature of wick winder, oil filler cap and any other part of the stove that may be necessary to touch during its operation shall not exceed 60°C when measured in accordance with procedure described in Annex E.

6.7 Fuel Temperature Test

The appliance with its fuel container filled with fuel to nearly three-fourths of its capacity shall be run for two hours, with a vessel containing water kept on the stove, at maximum blue flame setting. The maximum temperature of the fuel in the fuel container shall be measured. It shall not exceed 60°C.

6.8 Flame Flash-Back Test

After the final adjustment of the flame to the maximum blue flame setting, it shall not be possible to cause the flame to flash-back from the burner into the fuel container by bringing the wick down as far as it will go. This test shall be carried out with the wick burnt down to the lowest height at which the burner is capable of operation with a normal flame.

6.9 Stability Test

Stove, both when full of fuel and when empty, shall be capable of being tilted in any direction to an angle of 15° from the vertical, without overturning on being released.

6.10 Ability to Withstand Heavy Loads

The top plate of the stove or vessel supports, whichever the case may be, shall be so designed as to be adequately strong to withstand the load calculated in accordance with the following:

a) For circular top plate	Diameter in cm of top plate expressed in kg
b) For square frame	Side of the square in cm expressed in kg

6.10.1 The load as calculated above shall be applied uniformly distributed for a period of one hour. At the end of the test, there shall not be any deformation or permanent set of any component of the stove.

7 CATEGORIES OF TEST

The tests are classified into three categories, namely, type tests, acceptance tests and routine tests as given below:

Test	*Clause Reference*
Type tests	6.3 and 6.10
Acccptance tests	6.2,6.4,6.5,6.6,6.7,6.8 and 6.9
Routine tests	5.1, 5.2, 5.3, 5.4, 5.5 and 5.8

8 INSTRUCTIONS

8.1 Instructions giving complete information about the safe operation, filling and maintenance of the non-pressure stove shall be supplied with the stove. These shall be printed in Hindi and English and shall be supplied in the form of a durable booklet. These shall include the following:

a) Prior to lighting the stove, ensure that all the components are undamaged and properly assembled in accordance with the design.

b) Place the stove on a perfect level to ensure uniform flow of kerosene in the wick-trough. The level can be checked by placing a pan of water on the stove.

c) That the stove shall use kerosene only and the use of fuels other than kerosene is dangerous.

d) That it is dangerous to pour kerosene in the fuel container while the stove is burning and any short-cut or direct method of pouring kerosene into the fuel container should be avoided.

e) The maximum quantity or level of kerosene to be filled in the container for normal use.

f) Any special instruction for the safe and efficient use/operation of the stove shall be included.

8.1.1 Instructions for multi-wick type stoves shall specifically include the following information:

a) The stove shall not be used with any of the wicks missing.

b) While replacing the wicks, these should be replaced in all wick tubes and none of the tubes should be left unoccupied.

c) The recommendations of the manufacturer about trimming of the wick to achieve the maximum blue flame height and to extinguish the flame effectively.

8.2 The manufacturer shall indicate the useful heat output of the stove and other useful information relating to the stove.

9 MARKING

9.1 The name or trade-mark of the manufacturer and the country of origin shall be legibly and indelibly marked at a prominent place on the stove and also on the carton box in which the stove is packed.

9.2 BIS Certification Marking

The material may also be marked with the Standard Mark.

9.2.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act,* 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

10 PACKING

Packing shall be done according to best trade practices, or as agreed to between the purchaser and the supplier.

11 SAMPLING

Sampling and acceptance criteria for non-pressure stoves shall be as agreed to between the purchaser and the supplier. A recommended scheme for the same as given in Annex F.

ANNEX A

(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
144: 1950	Ready mixed paint, brushing, petrol resisting, air-drying, for interior painting of tanks and containers, red oxide (colour unspecified)
145 : 1950	Ready mixed paint, slushing, petrol resisting, air-drying for interior painting of tanks and containers, red oxide (colour unspecified)
146 : 1950	Ready mixed paint, brushing, petrol resisting, stoving, for interior painting of tanks and containers, red oxide (colour unspecified)
147 : 1950	Ready mixed paint, slushing, petrol resisting, for interior painting of tanks and containers, red oxide (colour unspecified)
410 : 1977	Cold rolled brass sheet, strip and foil *(third revision)*
513 : 1994	Cold rolled low carbon steel sheets and strips *(fourth revision)*
737 : 1986	Wrought aluminium and aluminium alloy sheet and strip for general engineering purposes *(third revision)*
1068 : 1993	Electroplated coatings of nickel plus chromium and copper plus nickel plus chromium *(third revision)*
1573 : 1986	Electroplated coatings of zinc on iron and steel *(second revision)*
1868 : 1996	Anodic coatings on aluminium and its alloys *(second revision)*
2932 : 1993	Enamel, synthetic exterior (a) undercoating, (b) finishing *(second revision)*
2933 : 1975	Enamel exterior (a) undercoating, (b) finishing *(first revision)*
3618 : 1966	Phosphate treatment of iron and steel for protection against corrosion
4905 : 1968	Methods for random sampling
5116: 1996	Domestic and commercial equipment for use with LPG — General requirements' *(third revision)*
6911 : 1992	Stainless steel plate, sheet and strip *(first revision)*

ANNEX B

(*Clause* 6.1)

CONDITIONS FOR CARRYING OUT ALL PERFORMANCE TESTS

B-l TEST ROOM CONDITIONS

B-l.l The air of the test room shall be free from draughts likely to affect the performance of the stove. The room temperature shall be maintained between 25 to 30°C.

B-l .2 At the start of the test, the stove and the kerosene in its container shall be at room temperature.

B-2 TEST KEROSENE

The kerosene to be used in conducting performance tests may be as supplied in the market but shall be free from water.

B-3 SETTING OF STOVE

B-3.1 Prior to the performance tests the stove shall be checked and examined to ensure that all components are undamaged and are properly assembled and levelled according to the manufacturer's instructions. The preparation of the wick and stabilizing of flame of the stove shall be done in accordance with the following procedure:

a) Trim the wick(s) according to manufacturer's recommendation;

b) Raise the wick(s) to the maximum height;

c) Fix the sleeves and light the stove with the help of kindler;

d) Allow the stove to burn for a period of 10 min during which it should be adjusted to maximum wick height at which an all round

e) Put the vessel and readjust the flame to get a maximum blue and stable flame.

B-3.1.1 In the manner prescribed above, the stove shall be operated at the maximum blue flame height for twq periods of approximately two hours each, after which the wick burning surface shall be carefully and uniformly smoothed unless the design of burner prohibits to do so. The loose char and protruding strands if any, shall also be removed.

ANNEX C

(Clause 6.2)

TEST FOR THERMAL EFFICIENCY

C-l METHOD OF TEST

C-l.l Fuel Consumption Test

The stove whose efficiency is to be determined shall be filled with kerosene up to three-fourths of its capacity. Allow the stove to burn for 10 min during which it should be adjusted to attain its maximum blue flame height. Place a 2 mm thick flat steel plate, covering the flame of the lighted stove and the lighted stove shall be weighed on a sensitive dial balance with an accuracy of 1 g. The stove shall be allowed to burn for one hour with an aluminium vessel having sufficient water in it. The stove shall be weighed again removing the vessel and with the flame covered by the same flat steel plate of 2 mm thick. The differene in initial and final weight of the burning stove shall give the fuel consumption rate in g/h.

C-l.2 Thermal Efficiency

The test is conducted by heating water in flat bottomed aluminium vessel (size of the vessel and quantity of water to be taken are selected from Table 1 depending upon the fuel consumption rate as estimated in **B-l.l)** and provided with aluminium lid having two suitable holes, one for inserting a cork for holding thermometer and other for stirrer of aluminium wire required for stirring the water. The vessel bottom from inside shall have bright finish. The water in the vessel is heated from initial temperature (± 2°C from the actual room temperature) to 90 ± 1°C. The temperature of the water shall be obtained by means of a mercury-in-glass thermometer, having an accuracy of 0.5°C and the bulb of which is immersed to half the depth of the water in vessel. Thermal efficiency is then calculated by dividing the heat absorbed by the vessel and water to heat supplied by the kerosene consumption.

C-l.2.1 Trim the wicks uniformly as per directions of the manufacturer, if provided. Again check the kerosene level in the tank which should be approximately three-fourths of the tank capacity. Take the aluminium vessel and fill with water (sizes of the vessels and the quantity of water to be taken are selected from Table 1 depending on the fuel consumption rate as estimated in **C-l.l)** at a temperature of ± 2°C from the actual room temperature.

Fit the stirrer and thermometer on the vessel lid. Light the stove and adjust the wicks till it gives blue flame at maximum flame height. Operate the stove for 10 min under maximum blue flame conditions.

Table 1 Aluminium Vessels for Thermal Efficiency Test

Fuel Weight of Consumption Rate g/h	Vessel Diameter (External) (± 5 Percent) (mm)	Vessel Height (External) (±5 Percent) (mm)	Total Vessel Weight with Lid g (±10 Percent)	Weight of Water in Vessel (kg)
(1)	(2)	(3)	(4)	(5)
Up to 100	180	100	356	2.0
101 " 130	205	110	451	2.8
131 "150	220	120	519	3.7
151 " 180	245	130	632	4.8
181 " 200	260	140	750	6.1
201 " 240	285	155	853	7.7
241 "270	295	165	920	9.4
271 " 300	320	175	1 100	11.4

C-l.2.2 Note the weight of the lighted stove with the flame covered by a 2 mm thick flat steel plate and start a stop watch at the time of recording initial weight of the burning stove. Put the vessel on the stove and start immediately second stop watch. Heat the water while stirring with the help of stirrer till it attains the temperature of 90 ± 1°C . Note the time required to heat the water from initial temperature (± 2°C from the actual room temperature) to the final temperature (90 ± 1°C,). Leave the vessel on the stove and let it burn for one hour. At the end of one hour, remove the vessel and note the weight of the lighted stove with the flame covered with the same flat steel plate of 2 mm thick. The difference in the initial and the final weight of the burning stove shall give the kerosene consumption rate in g/h. Thermal efficiency shall be calculated for two different vessels. If the individual thermal efficiency values differ by more than four units, the complete test shall be repeated.

C-l.2.3 In case an hourly fuel consumption obtained during the test as per **C-l.2.2** falls, above the highest or below the lowest limit of the range of kerosene consumption rate, on the basis of which the vessel was selected earlier, then the test should be repeated with a vessel based upon fuel consumption obtained during test as per **C-l.2.2.** The average of thermal efficiency calculated as per **C-l.2.2** and **C-l.2.3** would give thermal efficiency of the stove-

C-2 CALCULATION

C-2.1 (In SI Units)

Let

w = mass of water in the vessel in kg,

W = mass of vessel complete with lid and stirrer in kg,

t_1 = initial temperature of water in °C,

t_2 = final temperature of water in °C,

X = mass of fuel consumed per hour in kg, and

T = time in minutes taken to heat water from t_1 to t_2.

(Specific heat of aluminium = 0.896 KJ/kg°C. Calorific value of fuel = 43 960 KJ/kg).

Then

Heat taken by the vessel $= (W \times 0.896)\,(t_2 - t_1)$ kJ

Heat utilized for heating water $= w \times 4.186\,8\,(t_2 - t_1)$ kJ

Total heat utilized $= (W \times 0.896 + w \times 4.186\,8) \times (t_2 - t_1)$ kJ

Heat produce by fuel $= \dfrac{X \times T}{60} \times 43\,960$ kJ

Thermal efficiency, percent $= \dfrac{\text{Heat utilized}}{\text{Heat produced}} \times 100$

$$= \frac{(W \times 0.896 + w \times 4.186\,8)(t_2 - t_1)}{X \times T \times 43\,960} \times 60 \times 100$$

C-2.2 (In Metric Units)

Let

w = mass of water in the vessel in kg,

W = mass of vessel complete with lid and stirrer in kg,

t_1 = initial temperature of water in °C,

t_2 = final temperature of water in °C,

X = mass of fuel consumed per hour in kg, and

T = time in minutes taken to heat water from t_1 to t_2.

(Specific heat of aluminium = 0.214 kcal/kg°C. Calorific value of fuel = 10 500 kcal/kg).

Then

Heat taken by the vessel $= W \times 0.214\,(t_2 - t_1)$ kcal

Heat utilized for heating water $= w \times 1\,(t_2 - t_1)$ kcal

Total heat utilized $= (W \times 0.214 + w)\,(t_2 - t_1)$ kcal

Heat produced by fuel $= \dfrac{X \times T}{60} \times 10\,500$ kcal

Thermal efficiency, percent $= \dfrac{\text{Heat utilized}}{\text{Heat produced}} \times 100$

$$= \frac{(W \times 0.214 + w)\,(t_2 - t_1)}{X \times T \times 10\,500} \times 60 \times 100$$

NOTE — 1 kcal = 4.186 8 kJ

ANNEX D

(Clause 6.3)

TEST FOR COMBUSTION EFFICIENCY

D-1 EQUIPMENT

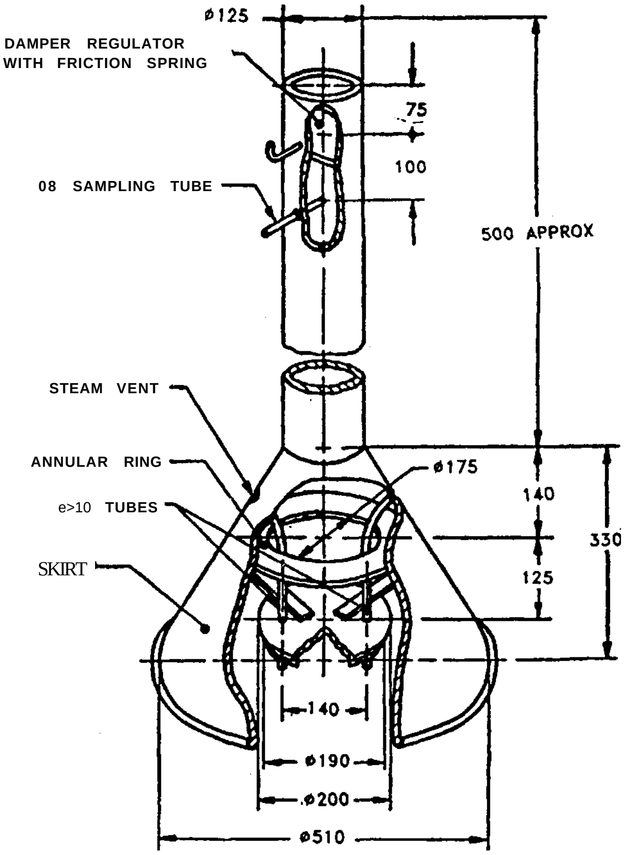
D-1.1 The stove shall be tested with its fuel container filled with kerosene to nearly three-fourths of its capacity. Before starting the test, a pan the type and size as **described in Table** 1 and **containing water** sufficient for the test shall be placed over the burner. In addition, a collecting hood (*see* Fig. 5) suitable for stove under examination shall be used.

D-1.1.1 The hood shall be so designed that, while not interfering in any way with the normal combustion of the burner, it collects a fairly high proportion of the flue gases. Also it shall be such that the sample collected represents the whole of combustion gases and not those from one particular point. When using hood, the damper provided shall be set, or additional flue pipe added, so that spillage of the flue gases around the skirt is minimised,

D-2 PROCEDURE

D-2.1 With the hood in position over the stove under investigation, the stove shall be lit and operated at full output (blue flame at maximum flame height) for a few minutes till a stable flame is achieved. Then a sufficient number of samples shall be collected.

D-2.2 Any of the recognized methods may be used for



All dimensions in millimetres.

FIG. 5 HOOD FOR BURNERS

gas analysis. For carbon monoxide, it is recommended that Co-indicator of prescribed accuracy or the iodine pentoxide method or catalytic method, for example, the Drager method, Katz method, or infra-red analysis may be used. Carbon dioxide may be tested with Orsat apparatus, Haldane apparatus or by the infra-red analysis.

D-2.3 Each burner shall be tested separately. The carbon monoxide and carbon dioxide contents of the product of combustion shall be determined by the methods capable of an accuracy of 0.001 percent and 0.05 percent, respectively of the volume o'f the sample.

ANNEX E

(Clause 6.6)

METHOD OF MEASUREMENT OF SURFACE TEMPERATURE

E-1 PREPARATION OF STOVE

The stove shall be tested with the fuel container containing approximately 75 percent of the amount of fuel which it would hold when full. The stove shall be lit and operated at the full output (blue flame at maximum flame height) for one hour before starting the measurement of temperature, with the vessel containing water placed over it. In case of a double burner stove, both the burners shall be lit simultaneously during this test.

E-2 PROCEDURE

be necessary to touch during its operation shall be measured by using a thermometer or any other suitable device for measuring the surface temperature. The temperature of each part shall be measured thrice every 30 min until equilibrium is reached. While measuring the temperature the thermometer shall be covered with a felt pad (or asbestos) and kept in contact with that part for sufficient period of time until the maximum temperature is reached.

ANNEX F

{*Clause* *11.1)*

SAMPLING SCHEME AND CRITERIA FOR CONFORMITY FOR NON-PRESSURE STOVE

F-l LOT

In a consignment all non-pressure stoves of the same construction and type shall be grouped together to constitute a lot, not exceeding 500 stoves.

F-2 SCALE OF SAMPLING

F-2.1 Each lot shall be inspected forjudging the conformity to the requirements of this specification.

F-2.2 From each lot, the required number of stoves given in col 2 of Table 2 shall be selected at random by using Random Number Tables *(see* IS 4905). These sample stoves shall be unpacked and examined for instruction sheets, construction details and leakage. Any stove which fails to meet one or more of the requirements of the above clause shall be termed defective. The number of defective stoves in the samples shall not exceed the acceptance number given in col 3 of Table 2, if the lot is to be accepted under this clause.

Table 2 Scale of Sampling

(Clause F-2.2)

Lot Size (1)	Sample Size (For Visual Examination and Leakage) (2)	Acceptance Number (3)
Up to 50	8	0
51 to 100	13	0
101 to 300	20	0
301 to 500	32	1

F-3 CRITERIA FOR PERFORMANCE REQUIREMENTS

F-3.1 If the lot is found satisfactory as per **F-2.2,** it shall be tested for performance requirements.

F-3.2 One sample stove at the rate of every 100 or part thereof among the lot shall be tested for each of the tests, thermal efficiency, flame stability, fuel creep, surface temperature, flame flash-back test, stability test, and container capacity. For the purpose of combustion efficiency and ability to withstand heavyload, one test for each lot of stoves shall be conducted.

F-3.3 The lot shall be deemed conforming to the requirements of performance if all the samples selected under this clause pass the tests.

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